

2. ALTERNATIVES

This section describes in detail the no-action alternative, the proposed action, and other reasonable alternatives that were studied in detail. Section 4, Affected Environment, presents the beneficial and adverse environmental effects of all alternatives in comparison form, providing a clear basis for the decision maker and the public to choose among the options.

2.1. PLAN FORMULATION METHODOLOGY

While the issues that surround the implementation of a regulation schedule for Lake Okeechobee are very complex, as are the various scientific and engineering models used, the planning process is relatively straightforward. Various lake regulation schedules were developed and proposed to replace the existing schedule, WSE. Extensive coordination with a wide array of governmental agencies (Federal, State and local) and the general public was performed to determine the acceptability of the schedules being considered.

This study only considered operational changes. Therefore, no structural features were considered except for those embedded in the SFWMM, which were common to all alternative schedules. There were also no real estate concerns since the lake is self contained and no real estate needs are present. This further simplified the planning process.

The modeling effort takes into account the most recent information on water related needs and demands. Some CERP related projects are still in the planning phase and have not been factored into the SFWMM at this time. These projects may eventually trigger further revisions to the current schedule.

At the beginning of the LORSS, the Project Deliver Team (PDT) developed a preliminary array of three alternatives, not including the No Action Alternative. The preliminary alternatives were referred to as Alternatives 1, 2 and 3. Alternative 1 was formulated to modify WSE on a small scale. Alternative 2 was formulated to have a wholesale change in the WSE regulation schedule and Alternative 3 was formulated in the previous regulation schedule study (USACE, 1999) and was referred to as Run 22AZE. Since this was the alternative preferred by many resource agencies at that time, this alternative was pulled forward to compete in the initial array of alternatives in the current study. This alternative did not perform as well in this study due to the STA flow constraints which allowed much higher lake elevations than previously modeled in the 1999 study. Therefore, Alternative 3 was screened from further analysis in this SEIS. The alternatives described in detail below are variations of Alternatives 1 or 2.

2.2. DESCRIPTION OF LORS ALTERNATIVES

The section below (Section 2.3) describes both in text and graphically, the proposed alternative lake regulation schedules. Included is the No Action Alternative (WSE), the base regulation schedule against which all the alternatives were compared.

Water levels in Lake Okeechobee are currently regulated by a complex system of pumps, spillways, and locks according to a regulation schedule developed by the Corps. The term “regulation schedule” refers to a compilation of operating criteria, guidelines, rule curves and specifications that govern storage and release functions of a reservoir. A regulation schedule is a tool used by water managers to manage the water levels in Lake Okeechobee. Typically, a regulation schedule has water level thresholds which vary with the time of year and trigger discharges (referred to as regulatory releases). The threshold lines of regulation schedules define the release zones and are traditionally displayed graphically. Additionally, a corresponding table is typically used to identify the structure discharge rules for release zones. Regulatory discharges are made primarily to protect the integrity of the surrounding levees and developed areas, and are also made to lower water levels in preparation for wet season inflows. For a multiple purpose lake, such as Lake Okeechobee, a regulation schedule attempts to balance competing objectives including flood control, water supply, navigation, and environmental needs. Thus, managing for better performance of one objective often leads to poorer performance in satisfying competing objectives. This is particularly true for Lake Okeechobee, where managing the lake water levels for the health of the littoral zone ecosystem may cause damaging flows to the St. Lucie and Caloosahatchee estuaries.

With the exception of the No Action Alternative, the alternatives evaluated in this study were developed to achieve a few common goals: to achieve zero or close-to-zero days above lake elevation 17.25 ft., NGVD; to provide a base flow to one or both of the estuaries to minimize the occurrence of high, damaging releases to the estuaries; to include a maximum limit of the lake regulatory releases passed through Stormwater Treatment Area-3/4 (STA-3/4), based on assumed treatment capacity given the current nutrient levels within Lake Okeechobee; and to provide lake operators with as much flexibility as possible to lower the lake stages when needed to achieve project objectives.

All of the alternatives modeled assumed pumping to the WCAs unconditionally when the Lake levels are in the highest Zone. The assumed treatment capacity constraint for STA-3/4 is simulated in the SFWMM by restricting the wet and dry season conveyance capacities for the Miami and North New River canals to pass approximately 58,500 acre-feet, average annual during the dry season and 4,700 acre-feet average annual during the wet season from the Lake to the STA-3/4. STA-3/4 is one of six large treatment wetlands managed by the SFWMD as part of the Everglades Construction Project. STA-3/4 was designed to capture stormwater runoff from the basins adjacent to the North New River and Miami Canals as well as to capture and treat regulatory releases from Lake Okeechobee. STA-3/4 is located immediately east (and north) of the

Holey Land Wildlife Management Area and north of WCA 3A and west of Highway U.S. 27.

All alternatives, except Alternative 2a and Alternative 2a-m, included similar use of the WSE meteorological guidelines and decision tree framework; all alternatives included use of a the Tributary Hydrological Conditions (THC) indicators concept, as found in WSE but modified to utilize the Palmer Drought Severity Index (in the place of net basin rainfall) and Lake Okeechobee net inflows (in the place of inflows at S-65E). The SFWMD Supply Side Management Line is assumed to be lowered by 1.0 feet from the current Supply Side Management line under all alternatives. The Supply Side Management is a computational method for allocating water under declared water shortages to Lake Okeechobee and the Lower East Coast Service Areas (LECSA). The assumption of a lowered Supply Side Management line serves as a surrogate for the Supply Side Management update effort anticipated to be completed by the SFWMD prior to implementation of a new Lake regulation schedule (to be identified by this LORS study), but the assumption is unable to be included as part of the No Action Alternative ; the assumption of a 1.0-foot lowering of the Supply Side Management line for all alternatives is based on a recommendation from the SFWMD technical staff working on the parallel effort to update the Supply Side Management rules. Completion of the SFWMD Supply Side Management update effort requires identification of the Preferred Alternative regulation schedule by the Corps.

The schedules which included the WSE decision tree framework were designed to increase operational flexibility. Considering the dynamic shifting of priorities for managing the Lake, it appears desirable to design flexible operating rules that give water managers some latitude to utilize best available multi-disciplinary information, and adjust operations as necessary to achieve a better balance of the competing objectives. Considering the potential benefits from recent lake inflow forecasting tools, and the rapid increase in the state-of-the art in forecasting technology, it is practical to establish more flexible rules which allow lake managers to utilize supplemental information and apply their sound judgement in making operational decisions. A detailed discussion of WSE will not be provided in this SEIS; however, differences from WSE will be discussed, below, as part of the individual alternatives.

All alternatives evaluated, including the No Action Alternative, assume operation of the SFWMD temporary forward pumps for water supply at S-354 (400 cfs), S-351 (600 cfs), and S-352 (400 cfs). Based on preliminary operational guidance from the SFWMD, the pumps simulated to trigger on for water supply demands if the Lake stage falls below 10.2 feet; the pumps are assumed turned off when the Lake stage recovers to 11.2 feet.

2.3. DESCRIPTION OF ALTERNATIVES

2.3.1. NO ACTION ALTERNATIVE (WSE)

The No Action Alternative is the current regulation schedule, WSE, with the addition of temporary forward pumps. The WSE schedule was approved in July 2000, with the first

releases occurring in July, 2002. The WSE regulation schedule (Figure 2-1) incorporates THC and climate forecasts into the operational guidelines and is used in conjunction with the Operational Guidelines Decision Tree. The Decision Tree is divided into two parts. Part 1 defines Lake Okeechobee discharges to the WCAs (Figure 2-2) and Part 2 defines Lake Okeechobee discharges to tidewater (Caloosahatchee and St. Lucie estuaries) (Figure 2-3). The operational flexibility of the WSE schedule allows for adjustments to be made in the timing and magnitude of Lake Okeechobee regulatory discharges based on conditions in the lake tributary basins and in the extended meteorological and climate outlooks. This schedule incorporates increased operational flexibility in the intermediate zones and permits excess water to be discharged from the lake at lower water levels when large inflows are expected, based on current and projected hydrologic conditions.

Figure 2.1

Figure 2.2

Figure 2.3

A key feature of the WSE schedule is the lower operational zone, labeled Zone D. This zone allows the operational flexibility to deliver water to the Everglades at lower lake water levels, which minimizes adverse impacts to the lake's littoral zone. If very wet conditions exist or are expected over the next six months, pulse releases may be initiated to tidewater in Zone D. The WSE schedule allows dry season discharges to tidewater to be gradually increased as necessary (up to the discharge rate recommended for the specific zone) to control water levels. This practice does not impact flood protection since there is no threat of hurricane surge during the dry season. The large outlet capacity virtually assures the ability to lower the water levels before the arrival of the hurricane season. This practice allows more water to be kept in the regional system for water supply and hydroperiod restoration.

2.3.2. ALT 1BS2-A17.25 (HEREINAFTER REFERRED TO AS 1BS2)

Alternative 1bS2 was developed from the current WSE decision tree structure. The regulation schedule and decision trees for Lake Okeechobee discharges to the Water Conservation Area (WCAs) and discharges to tidewater for Alternative 1bS2 are shown in Figures 2-4, 2-5, and 2-6, respectively. Operational experience under WSE and the availability of additional climatological data led to the following recommended modifications to WSE for this alternative:

1. Regulation schedule lines for Zone A, Zone B, and Zone C are lowered. If the stage of Lake Okeechobee exceeds 17.25 ft., NGVD, the regulation schedule decision tree specifies maximum practicable releases to the WCAs and tidewater. The lowering of the upper regulatory zones results in a regulation schedule that is more pro-active to limit potential high water conditions within the lake.

2. THC are applied that represent longer term wet or dry conditions that have persisted in the tributaries. Updated THC indicators enable the proposed regulation schedule to avoid frequent breaks in the regulatory outflows that may occur due to shorter dry periods. The Palmer Drought Index (PDSI) is proposed to replace the 30-day net rainfall, and the 14-day mean Lake Okeechobee net inflow (LONIN) is proposed to replace the 14-day mean S-65E flow. The classification bands for the PDSI and LONIN THC indicators are summarized in Table 2-1.
3. The line representing the divide between Zone D and Zone E is reshaped: the bottom of Zone D is flattened during the periods in which the estuary ecological systems may be more impacted by large freshwater discharges, especially in late winter, early spring, and during the October through November period. The modified regulatory line promotes a quicker response in the autumn and winter months to large inflows that often are generated during the hurricane season.

Table 2.1

Figure 2.4

Figure 2.5

Figure 2.6

4. A new base flow zone (zone D0) is established below the bottom of the re-shaped zone D. Base flow is allowed when Lake Okeechobee water levels are in zone D0 or above (zone C decision tree outcome for dry THC, seasonal, and multi-seasonal forecasts is base flow), but no base flow releases are called for when the stage falls below the bottom of Zone D (Zone D0). During the alternative formulation process, data and recommendations were evaluated and the recommended base flow release was determined to be 450 cfs to the Caloosahatchee Estuary (measured at S-79) and zero base flow to the St. Lucie Estuary. Risks to the water supply performance objective are anticipated to be minimized with the forward pumps assumed in place to allow for water supply at lower Lake water levels. The bottom of the base flow zone ranges from 11.5 ft. NGVD on May 31 to 13.0 ft., NGVD during October and November. For Figure 2-5 (discharges to WCAs), releases to the WCAs when in zone D0 adhere to the same decision tree as the remainder of zone D; for Figure 2-6 (discharges to tidewater), releases when in Zone D0 will be base flow, and the decision tree of zone D is not applicable.

THC and seasonal climate forecasts are updated to allow increased operational flexibility in managing lake stages, and specifically to avoid extreme high lake stages. A significant number of decision tree outcomes for THC and seasonal forecast are updated to allow the quicker release of lake water, as compared to

WSE (for example, “Extremely wet” THC is changed to “very wet” or “wet to very wet” is changed to “normal to wet”). The additional inclusion of Lake stages forecasted to rise into Zones A or B also introduces additional operator flexibility by allowing for utilization of all available hydrologic and meteorological forecasting data. The changes to WSE for Alternative 1bS2 are indicated by the red font in Figure 2-6.

5. Moderate to extreme high discharges to the St. Lucie Estuary are reduced by modifying the maximum discharge rates for zone B and zone C from 3500 to 2800 cfs and 2500 to 1800 cfs, respectively.

2.3.3. ALTERNATIVE 1BS2-M (Preferred Alternative)

Alternative 1bS2-M is similar to Alternative 1bS2, but with lowering of the second and third regulatory release lines and a lowering of the top three regulatory release lines during the late hurricane season from September 15 through November 1. Basically, Alternative 1bS2 simulation output (SFWMM model) showed the 17.25 feet stage criteria for Lake Okeechobee extreme high water to be exceeded for 12 days during the 36-year simulation period-of-record. Alternative 1bS2 was modified to remove any simulated daily stage in excess of 17.25 feet within Lake Okeechobee for safety issues with the HDD. The modifications to Alternative 1bS2 to create Alternative 1bS2-m are summarized below:

1. Regulation zones A, B, and C are lowered during the late hurricane season (September 30 stage breakpoints are changed to November 1)
2. Regulation lines for the bottom of zones B and C were lowered. Zone B breakpoints were first lowered to be mid-way between the bottom of Zone A and the bottom of Zone C. The bottom of Zone B was then lowered by an additional 0.15 feet and the bottom of Zone C was lowered by 0.10 feet, as required to achieve zero days with lake stage greater than 17.25 feet elevation. The simulated peak stage for Lake Okeechobee is 17.23 feet, during October 1995. The regulation schedule for Alternative 1bS2-m is shown in Figure 2-7; the decision tree remains unchanged from Alternative 1bS2 (Figure 2-5 and Figure 2-6).

2.3.4. ALTERNATIVE 2A-B (HEREINAFTER REFERRED TO AS 2A)

Alternative 2a represents a new approach to defining the regulatory release bands, based on a defined target operational guideline, and includes removal of the seasonal and multi-seasonal forecasting indices utilized under the WSE decision tree framework, and the addition of a new regulatory base flow zone for the Caloosahatchee Estuary.

The regulation schedule and decision trees for Lake Okeechobee discharges to the Water Conservation Area (WCAs) and discharges to tidewater for Alternative 2a are shown in Figures 2-8, 2-9, and 2-10, respectively. The operational details of Alternative 2a are summarized below:

1. The operational guideline was developed by the Corps of Engineers Water Management Section based on evaluation of historical stages of Lake Okeechobee from 1965 through 2005. As the lake stages increase further above the operational guideline, regulatory releases increase according to the specified regulatory bands;
2. The upper two regulatory lines were defined based on the probability (50% and 25%) of Lake Okeechobee stages reaching 17.50 feet within the next 90 days, assuming discharge outlets to tidewater were significantly limited. If the stage of Lake Okeechobee exceeds 17.25 ft., NGVD, the regulation schedule decision tree specifies maximum practicable releases to the WCAs and tidewater (same as Alternative 1bS2);
3. Below the operational guideline, base flow to the Caloosahatchee Estuary of 450 cfs is permitted but discontinued if the lake falls below the assumed 12.56 ft., NGVD elevation for navigation (Lake Okeechobee navigation may be impaired at lower stages) or the current Supply Side Management line, whichever is higher;
4. The decision tree for Alternative 2a includes removal of the seasonal and multi-seasonal forecasting indices utilized under the WSE decision tree framework, utilizing only the THC Indicators of the PDSI and LONIN, as used in all alternatives;
5. Regulatory releases from Lake Okeechobee to the Water Conservation Areas are discontinued when the lake stage falls below 13.50 ft., NGVD.

Figure 2.7

Figure 2.8

Figure 2.9

Figure 2.10

2.3.5. ALTERNATIVE 2A-M

Alternative 2a was modified to significantly reduce the frequency of extreme high discharge to the Caloosahatchee and St. Lucie estuaries, with the resulting alternative being Alternative 2a-m. The modifications to Alternative 2a are summarized below, and the regulation schedule is shown in Figure 2-11. The decision tree for Alternative 2a-m is unchanged from the decision tree utilized for Alternative 2a (Figure 2-9 and Figure 2-10).

1. Releases to tidewater for the regulatory band between the 25 percent and 50 percent high water probability lines (Blue band) are increased from 6500 cfs to Caloosahatchee / 3500 cfs to St. Lucie to 7500 cfs / 5000 cfs, with the intention to reduce the duration of extreme high estuarine discharges but also recognizing the possibility that these higher release volumes may cause additional impacts to public health and safety downstream of the St. Lucie lock.
2. Releases to tidewater for the regulatory band between the operational guideline and 13.50 ft., NGVD elevation (magenta band) is modified from a regulatory band for Caloosahatchee Estuary baseflow to a low level regulatory release of 800 cfs to the Caloosahatchee Estuary and 400 cfs to the St. Lucie Estuary. The magenta regulatory band was also extended to include the area between 13.50 ft., NGVD elevation and the operational guideline minimum elevation of 12.50 ft., NGVD, which was not included for Alternative 2a;
3. The bottom of the base flow regulatory band (bottom the orange band / top of red band) was modified to be consistent with Alternative 1bS2 and Alternative 1bS2-m, with a minimum elevation of 11.50 ft., NGVD and a maximum elevation of 13.0 ft., NGVD.

Figure 2.11

2.3.6. ALTERNATIVE 4-A17.25 (HEREINAFTER REFERRED TO AS 4)

Alternative 4 is a more aggressive modification, but similar to, Alternative 1bS2. Alternative 4 was intended to provide additional operational flexibility to manage the lake stages at lower levels than Alternative 1bS2. Alternative 4 includes higher maximum release magnitudes to tide for Zone B and Zone C, increased maximum release magnitudes to tide under dry seasonal forecast in Zone C and Zone D, and lowering of the top three regulatory release lines during the late hurricane season.

The regulation schedule for Alternative 4 is shown in Figures 2-12, 2-5 and 2-6. Alternative 4 includes all of the modifications to the No Action Alternative that were included in Alternative 1bS2, with the following additional modifications:

1. Maximum releases in zone B and zone C for normal to wet THC are unchanged from the No Action Alternative: 6500 to Caloosahatchee Estuary/3500 to St. Lucie Estuary in zone B and 4500/2500 in zone C. If the stage of Lake Okeechobee exceeds 17.25 ft., NGVD, the regulation schedule decision tree specifies maximum practicable releases to the WCAs and tidewater (same as Alternative 1bS2);
2. Regulation zones A, B, and C are lowered during the late hurricane season (September 30 stage breakpoints are changed to November 1);
3. Zone D decision tree outcome for THC “normal” and seasonal climate outlook “otherwise” (not “normal or wetter”), or THC “wet” or “normal” and multi-seasonal climate outlook “otherwise” (not “wet to very wet”) is changed from base flow to the Caloosahatchee Estuary to “up to level 1 pulse release”;
4. Zone C decision tree outcome for THC, seasonal climate outlook, and multi-seasonal climate outlook “dry” is changed from base flow to the Calosahatchee Estuary to “up to level 2 pulse release”;
5. Zone D0 for base flow to the Caloosahatchee Estuary is re-defined to discontinue base flow releases if the lake falls below the assumed 12.56 ft., NGVD elevation for navigation (Lake Okeechobee navigation may be impaired at lower stages) or the current Supply Side Management line, whichever is higher (Alternative 1bS2 allowed base flow to elevation 11.50 ft., NGVD at the minimum);
6. Consideration of active hurricane season forecast was recommended for inclusion with the THC decision, but this variable was not defined in detail adequate for SFWMM modeling, and it was therefore not included in the Alternative 4 simulation.

Figure 2.12

2.4. ISSUES AND BASIS FOR CHOICE

As listed in Section 1.8, many issues were identified and taken into account during the identification of the Preferred Alternative. Recommendations and feedback from the LORSS Project Delivery Team, stakeholders and the general public were considered. Meeting the LORSS objectives was an important factor in choosing the Preferred Alternative. The selected alternative attempts to meet the objectives for lower lake management, and improvements to estuary performance, while continuing to meet the Greater Everglades water requirements, as well as limiting the impacts to water supply and commercial navigation. Additionally, the issue of public health and safety based on the integrity issues of the HHD was a key factor in the decision making process to select a Preferred Alternative.

2.5. IDENTIFICATION OF THE PREFERRED ALTERNATIVE

The Preferred Alternative is 1bS2-m.

2.6. ALTERNATIVES ELIMINATED FROM DETAILED EVALUATION

Alternatives eliminated from further detailed evaluation are alternatives referred to as Alternative 3 and Alternative LORS-FWO. Alternative 3 was formulated in the previous regulation schedule study (USACE, 1999) and was a restudy of Run 22AZE. Since this was the alternative preferred by the resource agencies at that time, this alternative was pulled forward to compete in the initial array of alternatives in the current study. However, Alternative 3 (a.k.a. Run 22AZE) was screened from further analysis in this SEIS. Alternative 3 was eliminated because it did not perform as well in this study due to the STA flow constraints which allowed much higher lake elevations than previously modeled in the 1999 study. Additionally, Alternative 3 did not achieve zero or close-to-zero days above lake elevation 17.25 ft., NGVD. As discussed in Section 1.6, the 17.25 ft, NGVD, constraint is based on the lake stage criteria for safety issues related to the HHD.

Alternative LORS-FWO is similar to the No Action Alternative with a general lowering of the top two regulatory release lines and the addition of a new regulatory base flow zone to the Caloosahatchee Estuary. Alternative LORS-FWO was eliminated from detailed evaluation because it did not achieve zero or close-to-zero days above lake elevation 17.25 ft., NGVD.

2.7. COMPARISON OF ALTERNATIVES

Table 2-2 lists alternatives that were considered and summarizes the major features and consequences of the proposed action and alternatives. The Environmental Effects of the alternatives are described in Section 4.

[Table 2.2](#)